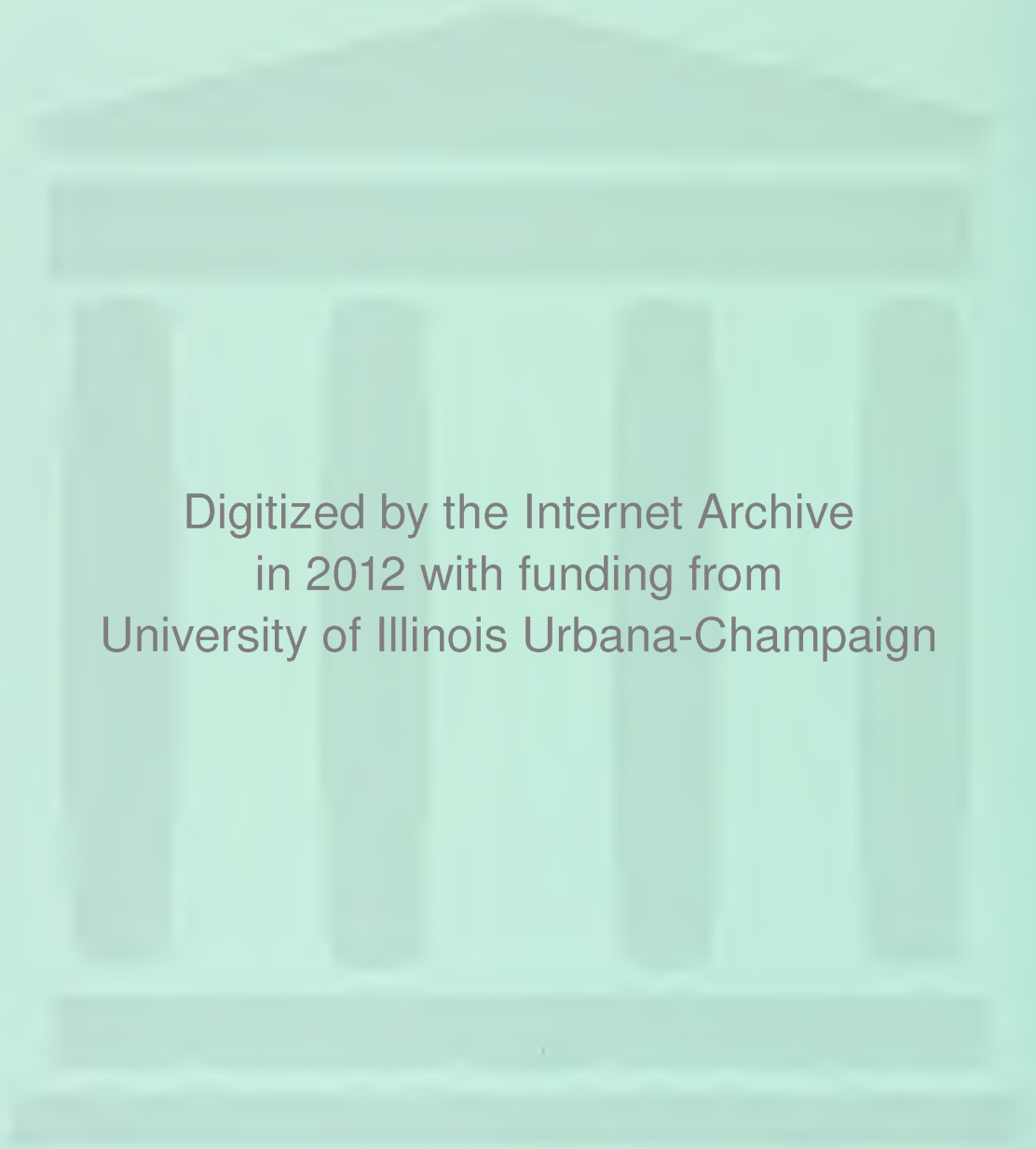

Faculty Working Papers

SIMULATING THE STRATEGIC FINANCIAL PLANNING PROCESS

James A. Gentry

#180

College of Commerce and Business Administration
University of Illinois at Urbana-Champaign

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by

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ABSTRACT

Strategic financial planning should (1) involve the key variables in the corporate growth process, (2) reflect the dynamic interaction in the system and (3) incorporate the dimension of uncertainty. Decision makers need a stochastic model that links the interaction between the investment and financing process for the planning period. The model presented in this paper integrates the investment and financing process by the use of simulation. The measure used to link these two systems is the rate of return required on new investment in order for decision makers to achieve their desired earnings-per-share growth goal.

VITA

James A. Gentry is an associate professor of finance at The University of Illinois in Urbana-Champaign. He received a DBA degree from Indiana University in 1966. Currently his research interests are in modeling the capital investment, long-run financing and working capital processes. He has published articles in CPCU Annals, Decision Sciences, Financial Management, Journal of Financial and Quantitative Analysis, and Journal of Risk and Insurance. Professor Gentry is a member of AIDS, American Risk and Insurance Association, American Finance Association, and Financial Management Association.

SIMULATING THE STRATEGIC FINANCIAL PLANNING PROCESS[1]

In strategic financial planning [2] a fundamental problem is integrating the investment and financing processes so that the decision makers can evaluate the chances of achieving their earnings-per-share (EPS) growth goal. The integration is a difficult task because the investment and financing systems are complex, probabilistic and dynamic. The crux of the problem is to design a comprehensive planning model that integrates the dynamics of the investment and financing variables for the entire planning period [1] [4] [8].

THE MODEL

EPS Growth Goal

In theory the objective of a firm is to maximize the wealth of its owners. Although this is sound theory, it is an abstract economic concept that does not come to grips with the operational problems of top-level management. The decision makers are responsible for making investment and financing decisions that involve many variables interacting in a dynamic environment with uncertain outcomes. The complex dimensions of these operational problems forces management to select proxies for wealth maximization that are available in the company's management information system. One of these proxies is the long-run growth in EPS.

Although the problems of measuring EPS are widely recognized and discussed, the decision makers often establish a long-run growth rate in EPS as the financial objective or target of the company. Professors Robichek and McDonald found the growth rate of EPS to be the most important

financial objective of 163 large industrial companies [7, p. 7]. Because long-run growth rate in EPS is directly related to the value of the company and is a widely recognized goal for financial management, the model assumes the long-run financial objective of the decision makers is to achieve growth rates in EPS that are acceptable to the major participants in a company's decision making domain [2] [6, Chapter 3],[7]. To accomplish this objective it is assumed the decision makers opt for a relatively stable and competitive mean growth rate of EPS for the defined planning period. Also it is assumed management has determined a set of investment alternatives that are worthy of consideration and will not change the risk class of the company.

Thus the task of the decision makers is to select investments that will combine with the existing assets and generate the desired EPS growth rates for the planning period. The purpose of this paper is to present a model that will assist top management in making these decisions.

Decision Variables

For strategic decisions top management must determine the following guidelines:

1) the general areas they prefer to make investments;

2) the rate of growth of new investment they can sustain in conjunction with the existing assets;

3) the financing strategy to be employed in acquiring funds for purchasing the new capital investment.

These guidelines identify the variables in the strategic financial planning process. In the model there are five major decision variables which reflect top-level management policy decisions. These decision variables are:

Desired growth rate of EPS. The perceived long-run financial objective of the decision makers.

Growth rate of investment. Management's judgment of the rate of growth in new investment the company can sustain.

Total debt/total asset ratio. The perceived debt limit or the financing variable.

PE ratio. A cost of equity variable.

Interest cost of total debt. A cost of debt variable.

Because there are uncertainties in the long-run financial planning process, it is assumed decisions are made sequentially rather than simultaneously. Furthermore, it is assumed the inputs for each variable are frequency distributions and not single point estimates. The decision makers assign discrete probability values to each of the five variables. Thus, it is assumed the process is stochastic and each variable operates independently within the defined limits established by top-level management. Also it is assumed the decision makers take into account the existing interrelationships among the variables when establishing the inputs.

Other Decision Variables

In addition to determining inputs for the five major decision variables, the decision makers need to specify single point estimates, i.e., beginning values, for each of the following variables:

Total assets

Total debt

Total Common Stock

Return on Tangible Assets

Interest on Total Debt

Percent EPS retained (1-payout ratio)

Investment in year 1

Dividend Policy Variable

It is assumed that dividend policy is a decision variable and is not random [5]. By having dividend policy as a separate subsystem of the long-run financing process, a series of decision variables emerge. These dividend policy variables require inputs. A discussion of these variables follows.

Minimum EPS Growth (MINGRO). The first dividend policy variable for management to establish is the percentage growth required in EPS before dividends per share (DPS) can be increased. For example, if the minimum EPS growth rate (MINGRO) was specified as 20 percent, EPS would have to increase at least 20 percent before DPS can be increased. Once DPS is increased, EPS must grow another 20 percent before DPS can be increased again.

Percent of EPS Growth to DPS (DP). This variable is the percent of the actual EPS growth that is to be allocated to DPS. This variable is only activated when EPS has achieved MINGRO. The DP variable offers substantial flexibility in establishing dividend policy. The model accommodates management's preferences for dividend policy. For example management might prefer DPS growth be equal to EPS growth, or alternatively prefer DPS to grow either more or less rapid than EPS.

Adjusted Dividend Policy (ADP). The ADP decision variable does not enter the financing process until all available sources of debt and retained earnings have been used to finance new investment. Also, ADP may enter if the current price of the common stock is lower than in the

previous years and management prefers not to sell stock at a depressed value. At this juncture management must decide if they wish to retain more earnings to finance the investment. If the decision is to retain more earnings, dividend policy is changed and management revises downward the original percent EPS growth to be allocated to DPS. If the decision is to maintain the same dividend policy no change occurs.

Maximum Debt/Asset Ratio (DDMAX). In the beginning, management specifies a probability distribution for the debt/asset ratio (DD). DDMAX enters as a decision variable if management wishes to change its DD policy in order to accommodate new investment. DDMAX becomes the new upper boundary of the DD ratio. Thus, if all sources of financing have been used, management has the option to increase the debt/asset ratio.

Incremental Changes in Debt/Asset Ratio (DDADD). DDADD is a decision variable that permits management to add marginal quantities of debt to the DD ratio but limits the amount of new debt that can be added in any given year. For example, assume the DD ratio is below its upper boundary, either the original or DDMAX, and management has the choice of adding more debt to finance new investment of seeking other sources of financing. If they choose debt, how much are they willing to take on in any given year, or alternatively how much are they willing to have debt/asset ratio increase in a given year. DDADD is the control variable that accommodates this decision. The larger the DDADD variable the more quickly the DD ratio will approach its upper boundary.

ROI - The Decision Criterion

In the EPS growth model, the decision criterion for accepting or rejecting investment alternatives is the rate of return required on new

investment (ROI) in order to achieve management's desired long-run growth in EPS. It is recognized that the generation of investment alternatives is a separate process that must occur before the EPS planning model can be used. It is assumed, therefore, that the decision makers have identified the investment projects they wish to evaluate.

The ROI measure is the product of a stochastic system that incorporates the several variables involved in the long-run financial planning process. Furthermore, ROI takes into account the uncertainty attached to each variable and the dynamic interaction between the investment and financial process throughout the entire planning horizon. Also the cash flows from the existing assets are included and most importantly ROI reflects the expectations of the decision makers. The ROI concept approximates an operational decision criterion used by management and it is presented in a probabilistic format. The derivation of ROI is presented in the Appendix.

ROI offers an analytical dimension to top management that is not available in the cost of capital analysis of investment alternatives. The cost of capital provides a static and deterministic economic framework for a firm to maximize owners' wealth. However, the critical operational problem is defining and measuring a company's cost of capital [2, p. 52]. Therefore, in order to compare ROI and cost of capital it is assumed, as risky as it is, that the wealth of the owners is maximized because the planned growth in EPS is achieved. An example will highlight the differences between ROI and cost of capital.

The cost of capital approach allows decision makers to ask the question,"What will be the growth rate in EPS given a single point cutoff rate?"

This approach assumes the interaction of the investment and financing variables remains stable throughout the planning period. The cost of capital approach assumes there will be no surprise events or dynamic changes occurring in the investment and financing activities of a company.

The ROI measure is cast in a dynamic and stochastic framework. Decision makers assume the variables in the investment and financing process behave in a relatively random manner within specified limits. It is assumed during the planning period substantial changes may occur in the investment and financing variables [3]. These assumptions indicate the variables determining cost of capital are changing throughout the planning period and the cost of capital is not a static deterministic variable. This analytical framework permits decision makers to ask the question, "What is the rate of return required on new investments if we expect to achieve an EPS growth rate within a desired range?"

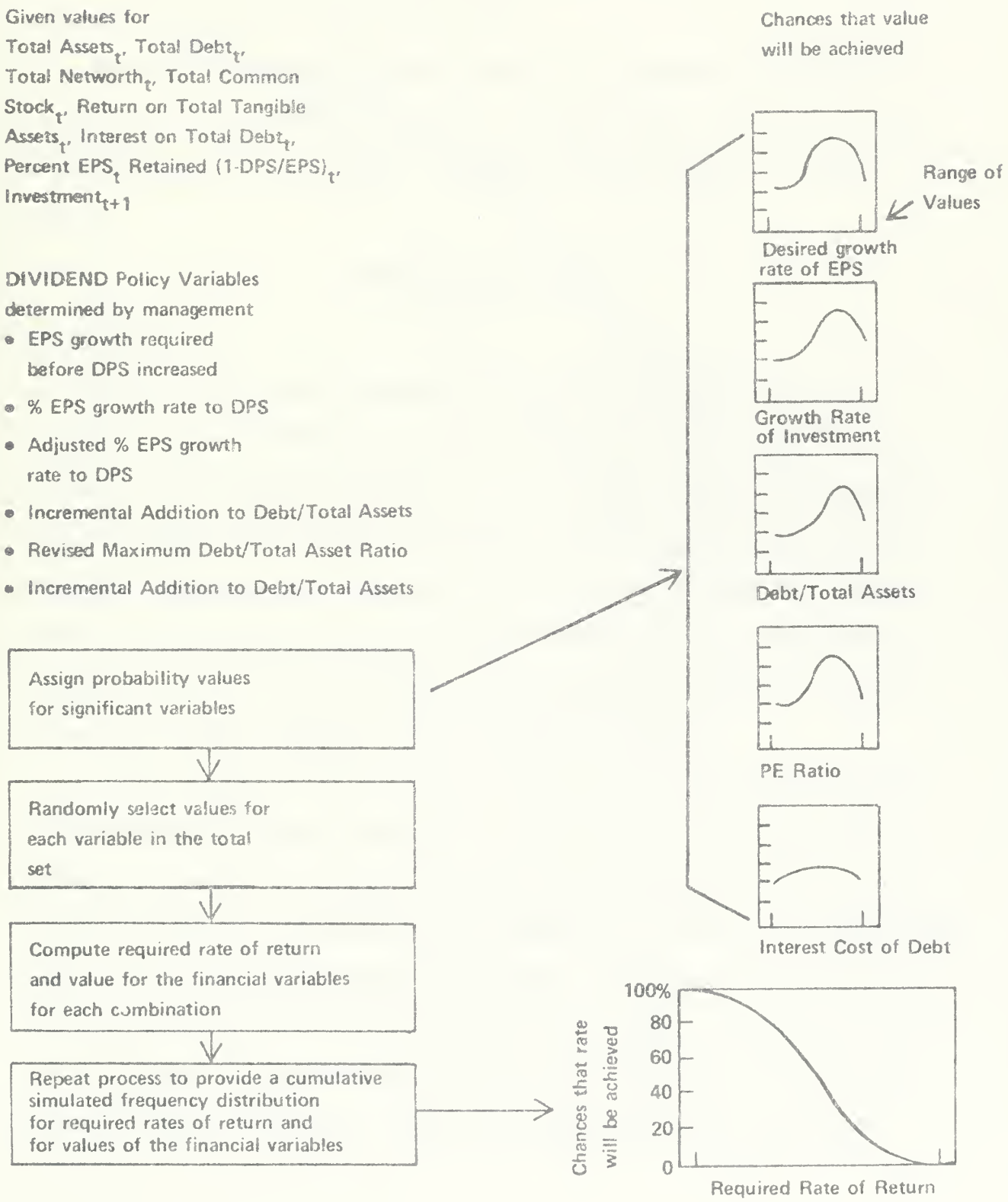
In summary, ROI is a comprehensive and dynamic measure of the linkage between the stochastic processes of investment and financing. The ROI measure offers decision makers substantive and probabilistic insights into the long-run financial planning process that are not available in the cost of capital approach.

Operation of the Model

Thus far only the variables involved in the model and the rationale for using the ROI measure have been discussed; therefore, a brief explanation of the overall operation of the model follows. Figure 1 depicts the variables in the model and serves as an operating illustration of the model. As indicated in Figure 1 the model randomly picks a value for each of the five decision variables. It combines these variables with a

FIGURE 1

SIMULATION OF THE LONG RUN FINANCIAL PLANNING PROCESS
WITH DIVIDEND POLICY A DECISION VARIABLE



set of balance sheet and income statement variables to compute the ROI. The balance sheet variables are updated each year and an ROI is calculated for each year in an eight year planning period. This eight year planning process is simulated at least 100 times.

The result of this simulation process is a frequency distribution of annual ROI's. Also distributions for each key variable are available plus means and standard deviations. An example of these data are presented later.

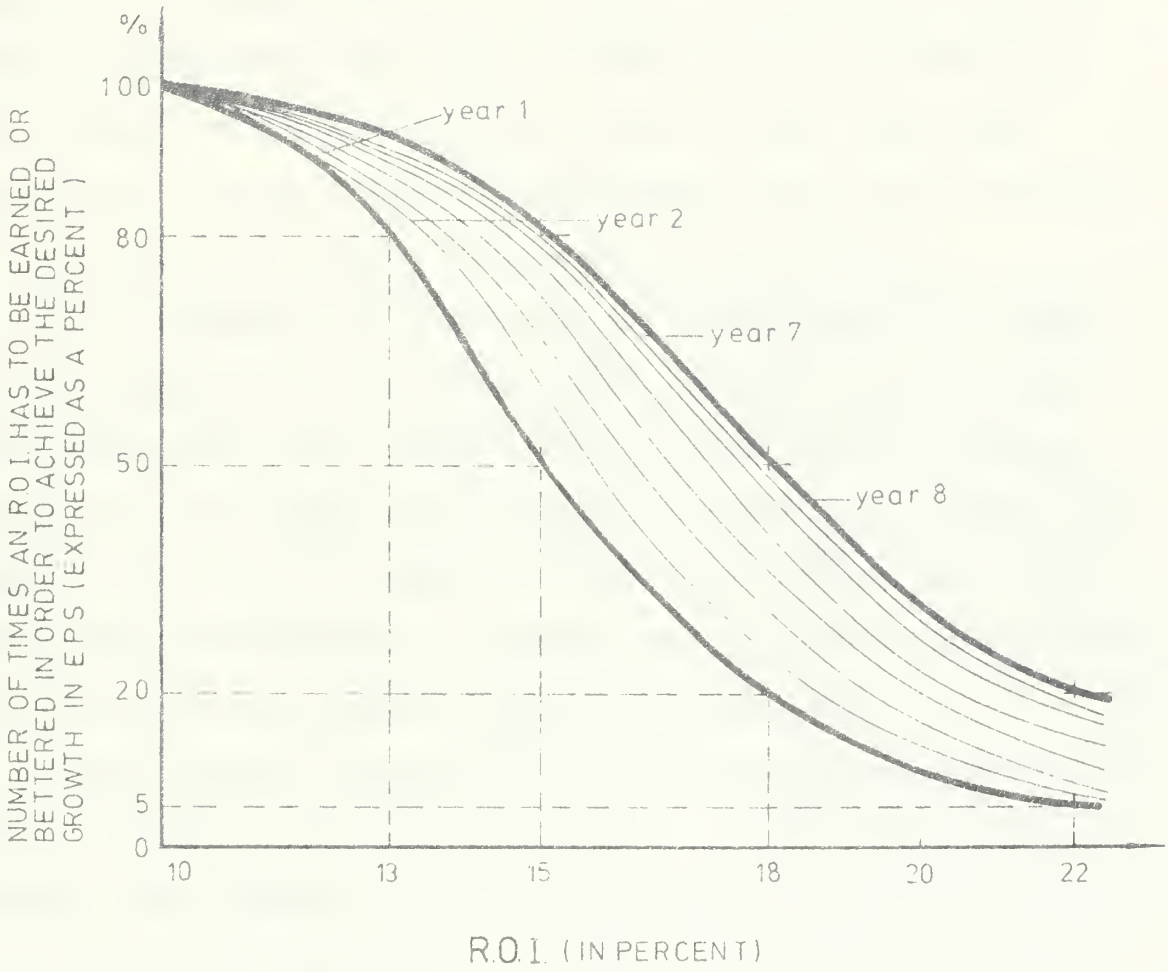
INTERPRETATION OF ROI

ROI Profile

Decision makers need a profile of the ROI values for each year in order to evaluate available investment opportunities. An example of an ROI profile is presented in Figure 2. This profile reflects the cumulative frequency distributions of the ROI's generated in each year of an eight year planning cycle. On the vertical axis is the number of times an ROI has to be earned in a given year in order to achieve management's EPS growth goal. On the horizontal xis are the ROI values. An example of how to interpret the ROI profile in Figure 2 follows.

In this example it is assumed the decision makers desired to achieve a 9 percent annual growth rate in EPS for an eight year planning period. Looking at Figure 2 it is apparent that new investment in year 1 will have to earn a minimum of 10 percent if the company is to achieve a 9 percent EPS growth goal throughout the eight year period. Furthermore, 80 percent of the time in year 1 new investment must earn 13 percent or more; 50 percent of the time ROI must be 15 percent or more and 20 percent of the time ROI must be at least 18 percent in order to achieve the desired EPS growth.

FIGURE 2
R.O.I. PROFILE FOR 8 YEAR PLANNING PERIOD



The ROI profile for year 8 is also presented in a dark color in Figure 2. In between the dark ROI profiles for years 1 and 8 are the lighter shaded profiles for years 2 through 7. The profile in year 8 shows that 80 percent of the time the company must earn 15 percent or more in order to achieve the 9 percent growth in EPS. Also the ROI profile indicates that 50 percent of the simulated ROI's were 18 percent or more and 20 percent of the ROI's were at least 22 percent.

With ROI profiles, decision makers can evaluate current and future investment opportunities and reflect on the chances of achieving their desired EPS growth goal. The ROI profile provides substantive insight concerning the investment and financing process within the company. For example if the profile is tightly centered around a single value, the distributions of the underlying variables also have narrow distributions, and vice versa if the profile is spread over a wide range.

Another important observation for decision makers is the spread between the beginning and ending ROI profiles. A narrow spread indicates the ROI's were stable for the entire planning period and the financing of the investment was easily achieved. Generally, this indicates the desired growth in EPS is not greater than in the past and/or there is no basic change in the inputs of the other variables compared to the past. A wide spread, where the ending ROI is substantially greater than the beginning ROI, shows returns on new investments were forced to increase in the latter years in order to achieve management's EPS growth goal. This finding generally occurs when management's desired EPS growth goal is substantially greater than in the past and/or the financing or investment variables are too limited to allow the future growth, thereby causing ROI

to rise. In this case financing is more difficult to achieve and more expensive. Thus the shape and location of the ROI profiles highlight the decision makers' expectations and th chances of achieving the EPS growth objective when the investment and financing variables are allowed to interact for the entire planning period.

USES OF THE MODEL

The EPS model provides management an inexpensive[2] overview of the total strategic financial planning process. The model is a tool for top management to ask questions such as, "What would happen to ROI if I changed....?" and immediately simulate the desired conditions. By analyzing the output data management can discover the possible outcomes to their planning questions.

Determining the sensitivity of ROI to increase or decrease for any of the five decision variables or the dividend policy variables is of primary importance to decision makers. For example, how sensitive is ROI to an increase in management's desired EPS growth rate? Or what would happen to ROI if management decreased the growth rate of investment throughout the planning period? Would ROI change significantly if management decided to increase the proportion of debt to total assets? Would an increase in the P/E ratio or the cost of debt cause ROI to change significantly? What would happen to ROI if management decided to retain more earnings? The power of the model is testing the sensitivity of ROI to changes in individual decision variables or combinations of variables. Also the cross sensitivity among the variables provides top management valuable insight into this dynamic corporate growth process.

The ROI profiles allow decision makers to reflect on basic strategic planning questions. For example, can the company achieve the projected ROI's for the next eight years? Were the ROI profiles stable throughout the period or are we trying to grow too rapidly? Does the shape of the ROI profiles reflect the uncertainty involved in the investment and financing variables for the planning period?

An example of the statistics generated by the model are presented in Table 1. Examples of a few strategic planning questions emerging from Table 1 are presented to illustrate the use of the model for decision makers. Will an increase in the debt/asset ratio from 50 percent to 59 percent in eight years cause an increase in the financial risk of the company? Also during the same period the percentage of earnings retained increased from 40 percent to 60 percent. Is this a justifiable decision? Except for small quantities of common stock sold in the 7th and 8th years, only debt and retained earnings were used to finance the investment. Is it a realistic policy to avoid the sale of common stock? Can the company expect to generate enough new investment alternatives to sustain a 12 percent average annual growth rate in investment for the planning cycle?

Although there are many other applications of the model, the general examples presented highlight the major uses of the model. Hopefully the EPS growth model provides a more enlightened understanding of the financial planning process and serves as a productive decision making tool.

TABLE I

MEANS AND STANDARD DEVIATIONS OF KEY OUTPUT VARIABLES FOR 8 YEARS
(millions ($) or percent)

Year	1	2	3	4	5	6	7	8
Investment ($)								
Mean	10.00	11.24	12.66	14.21	15.98	17.97	20.19	22.66
S.D.	0.0	0.12	0.18	0.25	0.32	0.40	0.51	0.59
New Debt Sold ($)								
Mean	7.38	7.97	8.79	9.93	10.96	11.99	13.67	14.57
S.D.	6.00	6.14	0.20	0.36	0.38	0.53	0.67	0.74
Ret. Earnings ($)								
Mean	2.62	3.27	3.87	4.28	5.02	5.98	6.46	7.63
S.D.	0.00	0.07	0.12	0.29	0.26	0.40	0.57	0.77
New Common Stock Sold ($)								
Mean	0.0	0.0	0.0	0.0	0.0	0.0	0.05	0.47
S.D.	0.0	0.0	0.0	0.0	0.0	0.0	0.22	0.93
Growth of Investment								
Mean	0.0	.125	.121	.123	.124	.125	.123	.123
S.D.	0.0	.011	.011	.012	.012	.010	.011	.011
Debt/Asset Ratio								
Mean	0.50	.522	.539	.554	.567	.577	.587	.592
S.D.	0.0	.002	.002	.003	.004	.006	.008	.008
Ret. Earning Ratio								
Mean	0.400	.454	.488	.451	.523	.566	.556	.596
S.D.	0.002	.006	.017	.019	.009	.011	.015	.017

FOOTNOTES

1. The author is very grateful to Professor Stephen Phyrr for his many thoughtful contributions related to this paper.

2. On our IBM 360/75, the cost of running this program is approximately $2.25.

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